

Global Chemical Composition and Regional Aerosol Optical Depth Forecasting During INTEX-NA Phase A

PI:

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We will provide forecasts of global chemical composition and regional aerosol optical depth (constrained with near-real-time satellite measurements) and real-time PM_{2.5} and O₃ measurements from the U.S. EPA national network to the INTEX-NA science team.

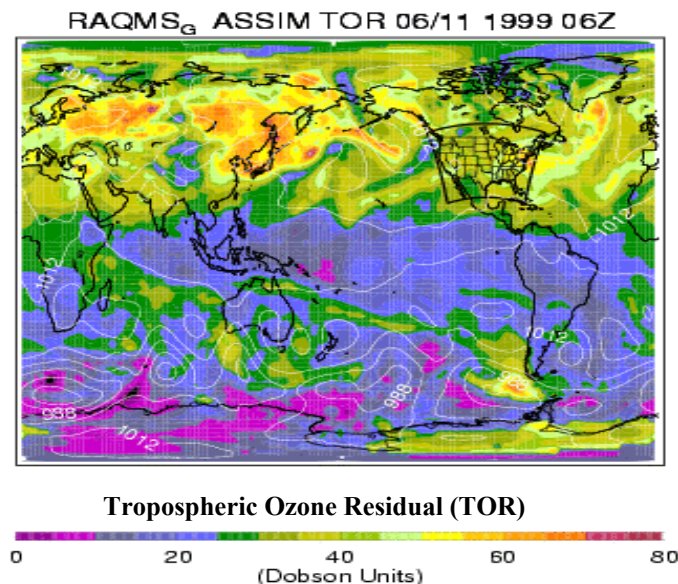
The global chemical composition forecasts use the LaRC/UW Regional Air Quality Modeling System (RAQMS), a multi-scale meteorological and chemical modeling system for assimilating satellite observations of atmospheric composition and predicting atmospheric trace gas distributions [Pierce et al., 2003]. The forecasts use on-line stratosphere/troposphere chemical calculations and are initialized with assimilated ozone distributions obtained from near-real-time solar occultation (HALOE, SAGE II, SAGE III, POAM II) and column (EP-TOMS) measurements. The RAQMS global predictions of chemical composition provide useful guidance for identifying large-scale continental inflow/outflow patterns and chemical aging studies during INTEX-NA. Post-flight, higher resolution hindcasts of chemical composition can be conducted over the continental US using the nested component of RAQMS to aid in the analysis of continental boundary layer chemistry and convective venting.

The regional aerosol optical depth forecasts use a data fusion/trajectory forecasting product developed under the Air Quality Index (AQI) project of the NASA AQ Applications Program. The data fusion/forecast combines near-real-time MODIS aerosol optical depth (AOD) and cloud optical thickness (COT), EPA surface fine aerosol (PM_{2.5}) measurements, NOAA Wild Fire Automated Biomass Burning Algorithm (WF_ABBA) fire count data, and trajectory forecasts to predict the movement of high MODIS AOD over the continental US [Szykman et al, 2004; Kittaka et al., 2004]. The MODIS AOD forecasts provide useful guidance for identification of elevated aerosol loading within the continental boundary layer and long-range transport of aerosols.

References

- Kittaka, C. et al., Utilizing MODIS satellite observations to monitor and analyze fine particulate matter, PM_{2.5}, transport event, extended abstract, Sixth Conference on Atmospheric Chemistry: Air Quality in Mega Cities, 84th Annual AMS Meeting, January 10-16th, 2004, Seattle, WA
- Pierce, R. B. et al., Regional Air Quality Modeling System (RAQMS) predictions of the tropospheric ozone budget over east Asia, *J. Geophys. Res.* 108, 8825, doi:10.1029/2002JD003176, 2003.
- Szykman, J. J. et al., Utilizing MODIS satellite observations in near-real-time to improve AIRNow next day forecast of fine particulate matter, PM_{2.5}, extended abstract, Sixth Conference on Atmospheric Chemistry: Air Quality in Mega Cities, 84th Annual AMS Meeting, January 10-16th, 2004, Seattle, WA

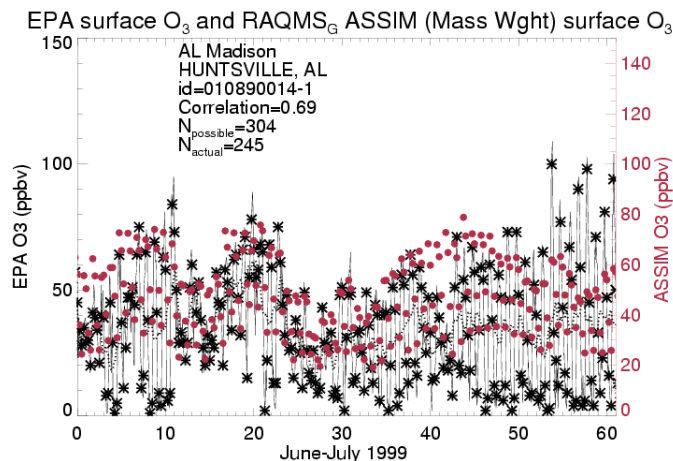
Examples of global chemical and regional aerosol forecasting and near-real-time analysis products for INTEX-NA day-to-day flight planning (PI, Pierce)



Sample RAQMS global ozone assimilation

Daily, 48hr global online chemical forecasts, initialized with near-real-time assimilated satellite O₃ measurements, will be provided to the INTEX-NA science team for flight planning support. Post-flight, continental US nested simulations will be conducted for analysis during the mission.

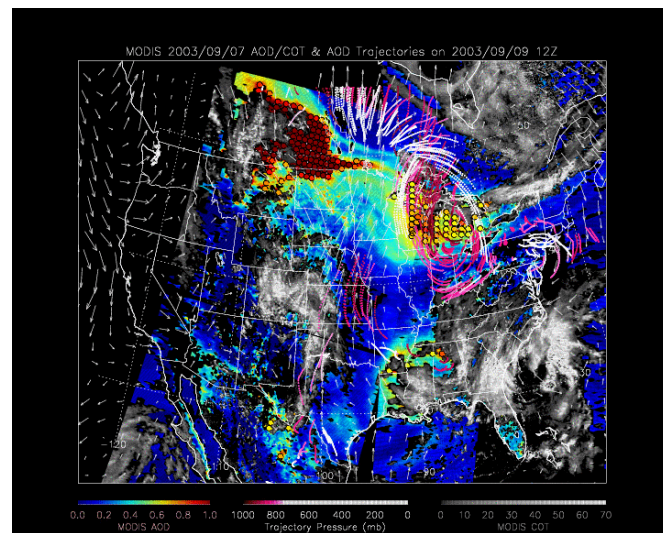
The 06Z June 11, 1999 assimilated tropospheric ozone column from 2x2.5° global component of the LaRC/UW Regional Air Quality Modeling System (RAQMS_G) is shown above. The 80x80km continental US domain for the nested component (RAQMS_N) is also indicated.



Near-real-time (24hr delay) evaluation of RAQMS_G forecast/EPA In-situ O₃ time series and correlations

Near-real-time evaluation/interpretation of the RAQMS_G and RAQMS_N forecasts will be conducted during the mission using EPA surface O₃ measurements.

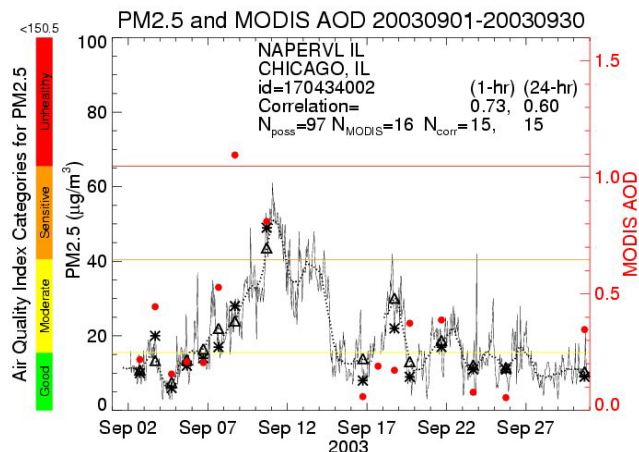
The June-July 1999 RAQMS_G/EPA In-situ O₃ mixing ratio plot shown above details correlation coefficients at a specific EPA monitoring site location.



Sample 48hr Trajectory Forecast for high MODIS AOD

Daily, 48hr regional trajectory forecasts of movement of high aerosol optical depth (AOD) air masses will be provided to the INTEX-NA science team for flight planning support.

The 48hr Sept. 7th, 2003 trajectory forecast valid at 12Z Sept 9th, 2003 shown above uses near-real-time (within 6hrs of MODIS overpass) daily MODIS AOD, daily MODIS cloud optical thickness (COT), and 3D air parcel trajectories from high (>0.6) MODIS AOD.



Near-real time (24hr delay) MODIS AOD /EPA In-situ PM2.5 time series and correlations

Near-real-time evaluation/interpretation of the MODIS AOD forecasts will be conducted during the mission using EPA surface PM2.5 measurements.

The site specific MODIS AOD / EPA In-situ PM2.5 mass concentration plot shown above details correlation coefficients at a specific EPA monitoring site location.